Journal of the Kansas Entomological Society

(Central States Entomological Society)

Vol. 25 July, 1952 Number 3

PUBLICATION COMMITTEE

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1889-1929

Entered as second-class matter June 7, 1939 at the Post Office at Manhattan, Kansas, under the Act of August 24, 1912.

JOURNAL OF THE KANSAS ENTOMOLOGICAL SOCIETY

A quarterly journal published in January, April, July, and October devoted to Entomology in the Western Mississippi Basin and the proceedings of the Kansas Entomological Society.

Manuscripts for publication may be sent to any of the publication committee.

The Kansas Entomological Society does not make exchanges since the Society does not maintain a library.

Subscriptions to the Journal must be paid in advance. The subscription rate is so low that second notices are not ordinarily sent out.

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Subscriptions in the U.S.A.,	**$2.00 per year**	**Single Copy**
Canadian or foreign subscriptions,	**$2.25 per year**	**75 cents**

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Vol. 25, No. 3, July, 1952

This issue mailed July 15, 1952

Kansas Entomological Society
Vol. 25 July, 1952 Number 3

A MONOGRAPHIC STUDY OF THE AFRICAN BIBIONIDAE (Diptera)

PART III, GENUS PLECIA

D. Elmo Hardy

(Continued from April issue)

Plecia (Plecia) freemani n. sp.*
Figs. 4a-b

This species is closely related to *Plecia ruficollis* Fabricius and is distinguished by male genital characters. The claspers are not so elongate as in *ruficollis* and each possesses an acute lobe on the ventral surface near its base (cf. figs. 4b and 9b). The posterior lateral margins of the ninth sternum of *freemani* are rather strongly produced and extend beyond the apices of the claspers, while in *ruficollis* they are scarcely produced and do not extend to the tips of the claspers. The submedian lobes, just inside each clasper, are more slender and elongate in *freemani* and the lobe in the middle of the posterior margin of the ninth sternum is about four times broader than the submedian lobes; not approximately equal in breadth to these lobes as in *ruficollis* (cf. figs. 4b and 9b). The posterior lateral margins of the ninth tergum are broadly bilobate in *freemani* and not so developed in *ruficollis* (cf. figs. 4a and 9a).

Male. The anterior fourth of the mesonotum is brown to black, the remainder is bright orange-yellow in color. The scutellum is brown, the pleura, remainder of body, and appendages are black. The antennae are missing from the specimen at hand, they are probably ten segmented as in *ruficollis*. The scape and pedicel are black. The mouthparts are moderately elongated, they are nearly as long as the head. The wings are dark brown fumose, the stigmata is concolorous with the remainder of the membrane. Vein R_3 is rather sharply bent near the base and forms about a 45° angle with vein R_{4+5}. The legs are densely black pilose, the segments are slender. The abdomen is rather thickly covered with black pile; it is about equal in length to the combined lengths of the head and thorax. The genitalia are as described above and shown in figures 4a and 4b.

Length: body, 5.5 mm.; wings, 6.0 mm.

Female. The antennae are eleven segmented. The segments are distinctly separated, the apical one is small and nipple-like. The median portion of the front is raised into two small tubercles on the lower portion just above the antennae. The front portion of the mesonotum is not so distinctly dark colored as in the male, just the anterior border, as well as the humeral ridges and humeri, is brownish.

* Named after Mr. Paul Freeman of the British Museum of Natural History whose wholehearted cooperation and interest in this study has aided the writer greatly.

Length: body, 5.7 mm.; wings, 6.7 mm.

Holotype male and allotype female: Limpasa Dambo, Nyasaland, August 12, 1949, coll. on cauliflower, acc. no. B105 (M. H. Breese).

Both have been returned to the Commonwealth Institute of Entomology. They will be placed in the British Museum (Natural History).

Plecia (Plecia) fuscinervis Hardy

Plecia fuscinervis Hardy, 1948, Brit. Mus. Ruwenzori Exped., 1934-'35, 1(6): 115-117, figs. 6a-d.

Type locality: Mt. Karangora, Uganda.

Type in British Museum (Natural History).

Plecia (Plecia) gilvipennis Hardy

Plecia gilvipennis Hardy, 1949, Jour. Kans. Ent. Soc., 22(3):94-95.

Type locality: Sikora, Madagascar.

Type in the Naturhistorisches Museum, Wien.

Plecia (Plecia) insolita n. sp.

Figs. 5a-b

This species is related to *erubescens* Speiser, the deeply cleft ninth tergum of the male, and the strange development of the ninth sternum, and clasping structures will distinguish it.

Male. All pile black. *Head*: Eyes bare, face rather sparsely pilose. Antennae eight segmented, scape and pedicel brown, flagellum yellowish with a light tinge of brown. Rostrum not strongly produced, folded tightly against the face and inconspicuous. *Thorax*: Brown to black in ground color and rather thickly gray pollinose. Mesonotum covered with minute punctules; these are more distinct on the sides. Humeri and scutellum brownish red, the latter with a black stria in the middle. Halteres black, stems faintly yellowish tinged. *Legs*: Femora yellowish brown, pale at their bases and darker at apices. Coxae, trochanters and tibiae brown with a slight yellowish tinge. Tarsi brown to black. Tibiae and tarsi very slender, sides nearly parallel. *Wings*: Dark brown fumose, stigmata not differentiated from the wing membrane. Costa extending almost half way between tips of veins R_{4+5} and M_1. Vein R_3 straight, forming about a 60 degree angle with R_{4+5}. *Abdomen*: Brownish black in color, rather thinly haired. *Genitalia*: Ninth tergum two times wider than long and with a deep concavity on the hind margin extending nearly to the base of the sclerite (fig. 5b). Ninth sternum and claspers very irregular in shape. The posterior margin of the sternum is developed into a pair of lobes on each side. The claspers are very large and almost square from a ventral view (fig. 5a).

Length: body, 4.0 mm.; wings, 4.7 mm.

Female unknown.

Holotype male: Bangan, Cameroons, February 14, 1916 (A. W. J. Pomeroy).

Type returned to the British Museum (Natural History).

Plecia (Plecia) madagascarensis Hardy

Plecia madagascarensis Hardy, 1949, Jour. Kans. Ent. Soc., 22(3): 95-96.

Type locality: Sikora, Madagascar.
Type in the Naturhistorisches Museum, Wien.

Plecia (Plecia) malkini n. sp.
Figs. 6a-b

This species is closely related to *P. bilobata* Hardy, fitting into the complex of species which has the mesonotum all rufous, the claspers bilobed and the ninth sternum developed into a pair of strong lobes on each side of the hind margin. It is distinguished from *bilobata* by the greater development of the outer lobes on the hind margin of the ninth sternum. The outer lobes extend well beyond the apices of the inner lobes of the sternum and beyond the apices of the claspers. In *bilobata* the outer lobes are shorter and more poorly developed than are the inner. They extend about half way to the apices of the latter and are about half as long as the claspers. In *bilobata* the outer lobes are narrower than the inner lobes and are acutely pointed at their apices. In *malkini* the outer lobes are comparatively broad, are two or more times broader than the inner, are rounded at their apices, and the inner margins are concave (fig. 6b). The inner lobes of the ninth sternum are acutely pointed at their apices and are shaped much as *bilobata*. The inner lobe of each clasper is indistinctly bilobed at its apex (fig. 6b). The ninth tergum is shaped as in *bilobata*. The hind margin is cleft almost to the base of the sclerite and the lobes of the sternum are acutely pointed and curved inwardly at their apices. The species otherwise fits the description of *bilobata* (Hardy, 1948:113).

Length. body, 4.0-4.5 mm.; wings, 3.5-4.0 mm.

Holotype male and allotype female: Benin City, Nigeria, January 28, 1949 (B. Malkin). Two male paratypes: Stanleyville, Congo, 25° 10′ E., O° 30′ N., January-February, 1915 (Lang and Chapin).

Type and allotype returned to the California Academy of Sciences. One paratype deposited in the United States National Museum and one at the University of Hawaii.

Plecia (Plecia) octodentata Hardy

Plecia octodentata Hardy, 1948, Brit. Mus. Ruwenzori Exped., 1934-'35, 1(6): 117-118, figs. 7a-c.

Type locality: Kampala, Uganda. The species is known from numerous localities in Uganda and the Belgian Congo.

Plecia (Plecia) quadrata n. sp.
Figs. 7a-b

This small species belongs in the *ruficollis* group and is most closely related to *P. redunca* n. sp. It is distinguished by the broad non-tapered lateral lobes of the ninth tergum of the male and by having the processes of the hind margin rounded, not spine-like.

Male. All pile black. *Head*: Eyes bare or nearly so, ocellar tubercle prominent. Antennae with eight or nine very closely joined segments. Rostrum not conspicuous. *Thorax*: Mesonotum orange colored except for a large blackish spot on the front margin. Humeri, scutellum and metanotum brownish. Pleura and halteres dark brown to black. *Legs*: Brown to black, the femora are slightly swollen on their apical halves. The tibiae have parallel sides and

are distinctly shorter than the femora. The tarsi are almost as long as the tibiae. *Wings*: Rather pale yellowish brown fumose, darker toward base and anterior margin. Stigmata brown, darker than the wing membrane. The costa extends about one-third the distance between the tips of R_{4+5} and M_1. Vein R_3 is almost straight and forms about a 65 degree angle with R_{4+5}. The petiole of M_1 and $_2$, from fork to crossvein, is slightly longer than the r-m crossvein. *Abdomen*: Dark brown to blackish, moderately pilose. *Genitalia*: Ninth tergum deeply cleft nearly to its base on hind margin, with a broadly 'U' shaped concavity in the middle of the hind margin. The lateral lobes of the tergum are strongly forcipate and are almost square at apices (fig. 7a). The ninth sternum is small compared to the tergum; it is much wider than long and has a pair of well developed, obtuse, lobes on the hind margin. The claspers are simple and slightly pointed on their outer apices (fig. 7b).

Length: Body, 3.5 - 4.0 mm.; wings, 3.8 - 4.2 mm.

Female unknown.

Holotype male: Chuka, British E. Africa, November 13, 1912, 4,500 ft., (G. St. J. Orde Browne).

Type returned to the British Museum (Natural History).

Plecia (Plecia) redunca n. sp.
Figs. 8a-b

This species is related to *P. quadrata* n. sp., and is distinguished by the slender pointed apices of the ninth tergum of the male and by the spine-like processes at the apex of the ninth sternum.

Male. All pile black. *Head*: Antennae entirely dark brown to black and composed of eight closely joined segments. *Thorax*: Mesonotum orange, except for the large black spot that covers the anterior portion. Humeri, metanotum and scutellum yellowish brown, the latter with a narrow black line down the middle. Pleura dark brown to black, faintly reddish tinged in the middle. Halteres black. *Legs*: Entirely black, femora slightly enlarged on apical halves, other segments slender. *Wings*: Smoky brown fumose, stigmata slightly darker than the membrane. Costa extending almost one-half the distance between tips of R_{4+5} and M_1. Vein R_3 straight or nearly so, entering the costa at about an 80 degree angle to R_{4+5}. The petiole of M_1 and $_2$, between the fork and the crossvein is just slightly longer than the r-m crossvein. Vein Cu_1 is rather strongly bent downward near its apex so that the cubital cell is noticeably narrowed at the wing margin. *Abdomen*: Dark brown to black, rather thickly pilose. *Genitalia*: Ninth tergum strongly forcipate, deeply cleft on the hind margin almost to its base. The lateral lobes are strongly tapered and pointed at their apices (fig. 8a). The ninth sternum is two times wider than long and has a spine-like development at apex on each side. The claspers are simple and acutely pointed on the outer apices (fig. 8b).

Length: Body, 4.0 mm.; wings, 3.8 mm.

Female. Antennae with nine very closely joined segments. Front with a rather strong ridge running from just above the antennae to the ocellar triangle. Ocellar tubercle moderately developed but not so prominent as in the male. The mesonotum is entirely bright orange, with no discoloration on the front margin. The humeri and scutellum are also all orange, except for

the median stria on the latter. The metanotum is chocolate brown in color and the abdomen is lighter brown than in the male.

Length: body, 4.3 mm.; wing, 5.0 mm.

Holotype male and allotype female on same pin: Kampala, Uganda, November 17, 1915 (C. C. Gowdey). Six paratypes, three males, three females: Same data as type, and Bwamba, April, 1944 (Van Someren).

Type, allotype and two paratypes returned to the British Museum (Natural History); two paratypes returned to the Commonwealth Institute of Entomology; one deposited in the United States National Museum and one in the University of Hawaii collection.

Plecia (Plecia) robusta Hardy

Plecia robusta Hardy, 1950, Expl. du Parc Nat. Albert, Miss. G. F. deWitte (1933-'35), fasc. 65:11-13, figs. 11-15.

Type locality: Bishakishaki, Belgian Congo.

Type in the Institut des Parcs Nationaux du Congo Belge, Brussels.

Plecia (Plecia) ruficollis (Fabricius)

Figs. 9a-b

Tipula ruficollis Fabricius, 1781, Spec. Ins., 2:410.
Plecia dorsalis Macquart, 1838, Dipt. Exot. I, 1:86.

This species has caused considerable controversy and has never been clearly defined. The writer has had an opportunity to study a large series of specimens from or near the type locality and there appears to be just one species in South Africa which has the top of the thorax rufous. This is no doubt the species which Fabricius had before him and also is apparently the one which Macquart described as *Plecia dorsalis*.

P. ruficollis is distinguished from all related species by the simple, slender claspers and by the lack of development of the posterior lateral margins of the ninth sternum of the male (fig. 9b).

Male. All pile black. *Head*: Black, eyes with a few very short inconspicuous hairs. Rostrum well developed, folded beneath the head in normal position. Antennae ten segmented. *Thorax*: Mesonotum and scutellum chiefly opaque red, front margin of mesonotum and middle of scutellum dark brown to black. One specimen on hand, from Natal, has the mesonotum all rufous. Humeri and metanotum dark reddish brown. Pleura black with a faint brownish tinge. Knobs of halteres black, stems slightly yellowish. Thorax almost bare, with conspicuous pile only on the upper part of the sterno pleura. *Legs*: Dark brownish black, femora moderately swollen, tibiae and tarsi slender. *Wings*: Dark brown fumose, stigmata not darker than the wing membrane. The costa extends one-third of the distance between the tips of veins R_{4+5} and M_1. R_3 rather strongly curved, forming about a 40 degree angle with R_{4+5}. *Abdomen*: Dark brownish black. *Genitalia*: Ninth tergum nearly two times wider than long, rather gently concave on the hind margin (fig. 9a). Cerci rather elongated. Ninth sternum about as long as wide and with three small rounded lobes in the middle on hind margin. The claspers are slender and slightly pointed on their outer apices. (fig. 9b).

Length: body 5.0 - 6.0 mm.; wings, 6.5 - 7.0 mm.

Female. Antennae composed of eleven well defined segments. Eyes distinctly short pilose. The front portion of the mesonotum varies from brown to black, as in the male, to entirely reddish yellow. The humeri are usually brown but sometimes are chiefly reddish. Otherwise as in the male, except for genital characters.

Length: Body, 5.5 - 7.0 mm.; wings, 6.3 - 7.5 mm.

Type locality: Cape of Good Hope.

Location of type not known, Macquart said it was in the Lalande Museum. It may possibly be in the Musèe d'Histoire Naturelle, Lille.

The writer has identified the species from the following localities: Cape Province, Sommerset East, September 1930 (R. E. Turner); E. Cape Prov. Katberg, 4.000 ft., October 1932 (R. E. Turner); Port St. Johns Pondoland, September 1923 (R. E. Turner); On road N'Vezane, Zululand, August 25, 1935; Eshowe, Zululand, April 1-22, 1926 (R. E. Turner); Orange F. State, Harrismith, March 1-20, 1927 (R. E. Turner); Cape Prov. Port Elizabeth, November 29, 1931 (L. Ogilvie); Natal, Durban, August 17, 1913 (L. Bevis); Pretoria, Transvaal (W. L. Distant - H. K. Munro); Nyasaland, Mlanje, March 23, 1941 (J. B. Davey); Lourenco Marques, Mozambique, (C. W. Howard); M'fongosi, Zululand (W. E. Jones); Brakfontein b. Delmas, Transvaal, 1924 (Lingnau); Salisbury, S. Rhodesia, September 1927 (A. Cuthbertson) and Umtali, S. Rhodesia, September 1927 (A. Cuthbertson). Edwards has recorded the species from: Zululand, German East Africa, British E. Africa, Transvaal, Cape Molo, Mau Escarpment and Sea Park, Natal, July 1950 (A. L. Carpenter).

Plecia (Plecia) sana Hardy

Plecia sana Hardy, 1948, Brit. Mus. Ruwenzori Exped., 1934-'35, 1(6):118-119, figs. 8a-b.

Type locality: Kalinzu Forest, Uganda.

Type in British Museum (Natural History).

Plecia (Plecia) scenica n. sp.

Figs. 10a-d

This species belongs in the group having the thorax all rufous, it is most closely related to *P. aliena* Hardy. *P. scenica* is distinguished by its square tipped claspers and by the broad and rounded median lobes of the ninth tergum.

Male. Pile chiefly dark brown to black, sometimes with yellowish pile on the abdomen. *Head*: Rostrum small, not well developed. Eyes bare, ocelli on a very prominent tubercle. Antennae nine segmented, the ninth segment is represented by a small nipple-like apex closely joined to the eighth. Antennae chiefly brownish with a slight yellowish tinge, especially on the basal segments. The first flagellar segment is two times longer than the pedicel. *Thorax*: Entirely yellowish red, only the tegulae are darkened. Bases of halteres yellow, knobs yellowish brown. *Legs*: Coxae and trochanters yellowish, remainder of legs chiefly brown to blackish; femora tinged with red in their ground color. *Wings*: Dark brown fumose, stigmata concolorous with the membrane. Costa extending slightly more than one-third the distance from

tips of veins R_{4+5} and M_1. Vein R_3 straight, entering the costa at about a 50° angle to R_{4+5}. Anal vein very weak. *Abdomen*: Brown to blackish, thickly pilose; the specimens from West Africa are black pilose, those from Tanganyika are brownish yellow pilose except at the apex of the abdomen. *Genitalia*: Posterior margin of ninth tergum with a pair of well developed lateral lobes and a pair of broad, obtuse, median lobes; the latter have a small 'V' shaped cleft between them (fig. 10a). The ninth sternum is nearly two times wider than long, its hind margin is simple, except for a pair of small densely haired tubercles just inside the claspers. Claspers simple, rather large and conspicuous and truncate at apices (fig. 10b).

Length: body, 5.5 - 6.0 mm.; wings, 6.5-7.0 mm.

Female: The antennae are distinctly nine segmented. Ocellar tubercle rather small and inconspicuous. Front with a distinct tubercle in middle just above antennae. *Genitalia*: Ninth tergum very short, from a dorsal view it is four to five times wider than long (fig. 10c). The tergum is expanded at the sides and extends around to the ventral portion of the genitalia. Cerci large and oval in shape. The eighth sternum is divided into two large plates, the inner margin of each plate has a large obtuse lobe at its apex and another smaller lobe just below this (fig. 10d). A sclerotized egg guiding structure extends between the two plates and appears to be attached on the inner surfaces of the two small median lobes.

Length: body, 5.5 - 6.5 mm.; wings, 7.0 - 8.3 mm.

Holotype male and allotype female: Njala, Sierra Leone, at light, August 14, 1928 (E. Hargreaves). Eight paratypes, two males, six females: four, same data as type; four, Aburi, Gold Coast, 1912 - 1923 (W. H. Patterson and G. S. Cotterell).

Type, allotype and five paratypes returned to the British Museum (Natural History); two deposited in the United States National Museum and one at the University of Hawaii, Honolulu, T. H.

Since the above description has been written and the type returned six specimens have been studied from the following locality: Ugano, Tanganyika Terr., Matengo-Hochland, WSW. V. Songea, March 11-20, 1936 (Zerny). These were in the Naturhistorisches Museum, Wien.

Plecia (Plecia) ugandaensis Hardy

Plecia ugandaensis Hardy, 1948, Brit. Mus. Ruwenzori Exped., 1934-'35, 1(6);119-121, figs. 9a-d.

Type locality: Kilembe, Uganda. Known from numerous localities in Uganda and also from S. Rhodesia and the Belgian Congo.

Type in British Museum (Natural History).

Plecia (Plecia) uncinata Hardy

Plecia uncinata Hardy, 1948, Brit. Mus Ruwenzori Exped., 1934-'35, 1(6): 121-122, figs. 10, 11a-b.

Type locality: Budongo Forest, Uganda. Known from several localities in Uganda and the Belgian Congo.

Type in British Museum (Natural History).

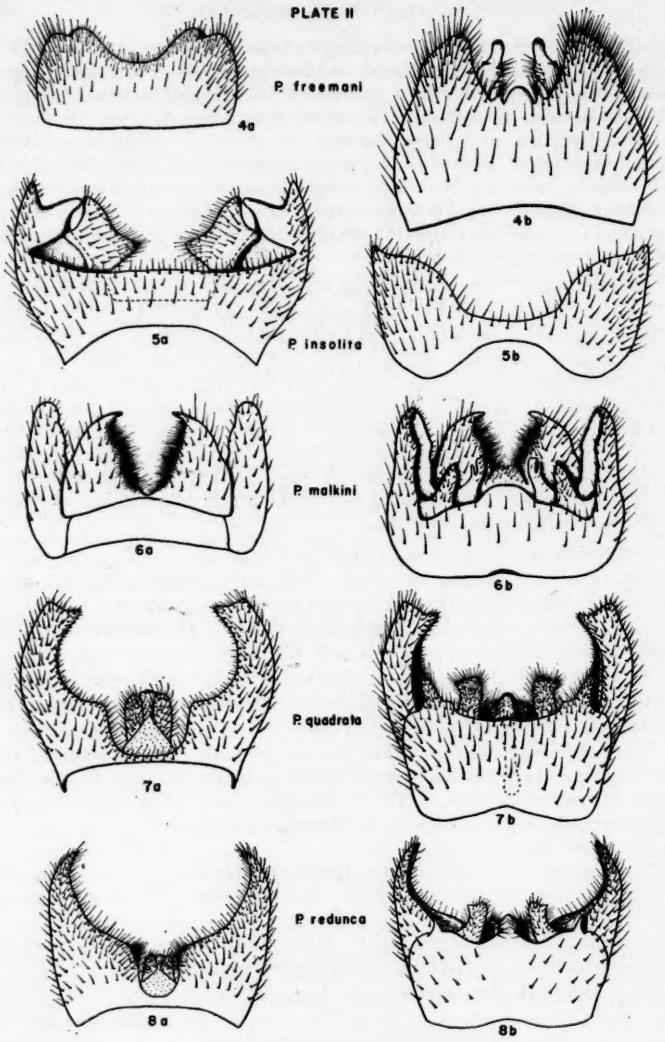

PLATE 2.

Fig. 4. *P. freemani* n. sp. a. ninth tergum, male; b. male genitalia, ventral.
Fig. 5. *P. insolita* n. sp. a. male genitalia, ventral; b. ninth tergum, male.
Fig. 6. *P. malkini* n. sp. a. male genitalia, dorsal; b. male genitalia, ventral.
Fig. 7. *P. quadrata* n. sp., a. ninth tergum, male; b. male genitalia ventral.
Fig. 8. *P. redunca* n. sp. a. ninth tergum, male; b. male genitalia, ventral.

Plecia (Plecia) wittei Hardy

Plecia wittei Hardy, 1950, Expl. du Parc Nat. Albert, Miss. G. F. de Witte (1933-'35), fasc. 65:7-10, figs. 6-9.

Type locality: Ruanda, Belgian Congo.

Type in the Institut des Parcs Nationaux du Congo Belge, Brussels.

Plecia (Plecia) yabaensis n. sp.

Figs. 11a-b

This species is related to *P. bilobata* n. sp. It is distinguished by having just a single lobe on each side at the apex of the ninth sternum of the male and by the deeply bilobed clasping structures.

Male. All pile black. *Head*: Antennae nine segmented, chiefly brownish with a slight tinge of yellow. *Thorax*: Humeri, mesonotum metanotum and scutellum entirely bright orange, except for a very narrow brown stria in the middle of the scutellum. Pleura dark brown to blackish with a yellowish red tinge in the middle. Bases of halteres yellowish, knobs dark brown to black. *Legs*: Dark reddish brown to blackish, all segments slender. *Wings*: Light brown fumose, stigmata slightly darker than the membrane. Costa extending nearly half way between the tips of veins R_{4+5} and M_1. Vein R_3 nearly straight, just slightly curved near the base and forming a 60 degree angle with R_{4+5}. *Abdomen*: Brownish black, rather thickly pilose. *Genitalia*: The ninth tergum is nearly two times as wide as long and the hind margin is very deeply concave, cleft nearly to its base. The lateral lobes of the tergum are acutely pointed at apices (fig. 11a). The ninth sternum has a pair of large rounded lateral lobes and a median mound-like gibbosity. The claspers are developed into two elongate arms, the outer arm is slightly larger than the inner (fig. 11b).

Length: body, 5.5 mm.; wings, 5.7 mm.

Female unknown.

Holotype male: Yaba, August 28, 1909 (W.M.G.), six paratype males: Aburi, Gold Coast, January 1911-1913 (L. Armstrong and W. H. Patterson) and Eala, Belgian Congo, April-July, 1935-1936 (J. Ghesquiere).

Type and one paratype returned to British Museum (Natural History); one paratype returned to the Commonwealth Institute; two returned to the Musèe Royal d'Hist. Nat. de Belgique; one deposited in the United States National Museum and one in the University of Hawaii collection.

Plecia (Plecia) zernyi n. sp.

Figs. 12a-c

This species belongs in the group of all black *Plecia* and appears most closely related to *P. madagascarensis* Hardy. *P. zernyi* is smaller in size, the petiole of cell M_1 is about equal in length to the r-m crossvein, the antennae are nine segmented and the male genitalia are very differently developed. The posterior lobes of the ninth tergum are much more slender and elongated, not short and thick as in *madagascarensis*. The ninth sternum and clasping structures are very differently shaped in the two species, the most striking distinguishing characters in *zernyi* are the presence of a strong spine-like lobe on each side of the apex and the peculiarly shaped claspers (fig. 12c).

Male. Entirely opaque, brownish black species; pile all black. *Head*: Ocellar tubercle very prominent. The antennae are nine segmented, the apical

PLATE III

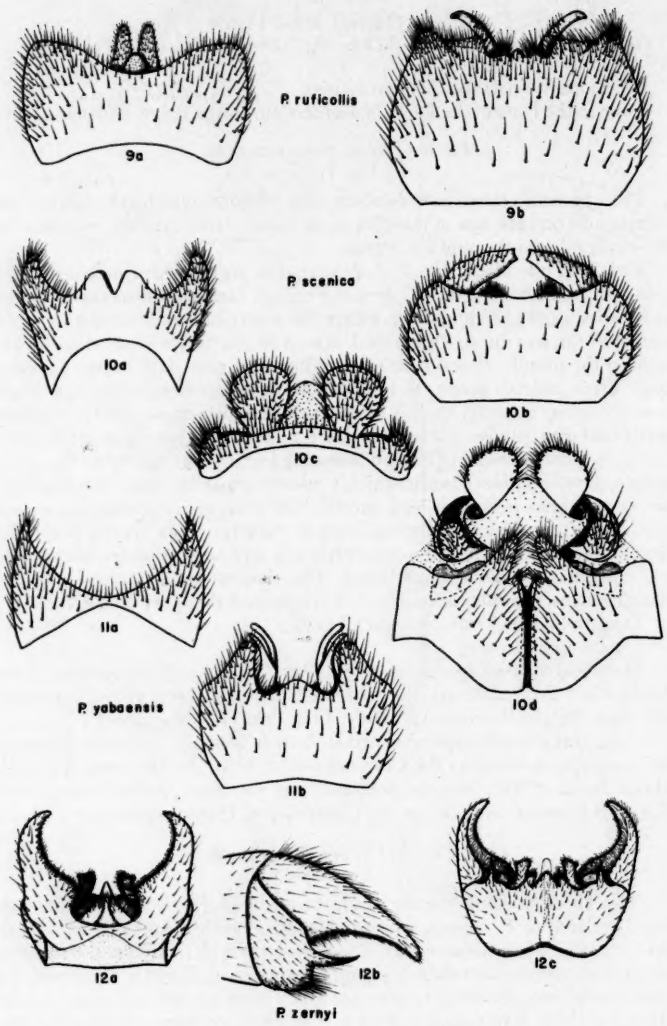

PLATE 3.

Fig. 9. *P. ruficollis* (Fabricius). a. ninth tergum, male; b. male genitalia, ventral.

Fig. 10. *P. scenica* n. sp. a. ninth tergum, male; b. male genitalia, ventral; c. female genitalia, dorsal; d. female genitalia, ventral.

Fig. 11. *P. yabaensis* n. sp. a. ninth tergum, male; b. male genitalia, ventral.

Fig. 12. *P. zernyi* n. sp. a. male genitalia, dorsal; b. male genitalia, lateral; c. male genitalia, ventral.

segment is small but distinct. The first flagellar segment is equal in length to the first two antennal segments. *Thorax*: Opaque brownish black almost devoid of pile. The mesonotum and scutellum are covered with grayish pubescence, this is most conspicuous on the sides and hind portion of the mesonotum. Mesonotum finely punctulated on the sides. Mesonotal furrows moderately developed, not deeply grooved. Halteres brown with a faint yellowish tinge on the stems. *Legs*: Entirely black and densely covered with moderately long black pile. Hind femora slightly swollen on the apical halves. All tibiae and tarsi slender, the segments are parallel sided. *Wings*: Brown to blackish fumose, stigmata but little darker than the remainder of the wing. The apex of vein R_{1+2} is situated about two-thirds the distance between the tips of Sc. and R_3. R_3 is oblique in position and forms a 60° angle with R_{4+5}. Vein R_3 arises at a point one-third the distance from the r-m crossvein to the end of R_{4+5}. The petiole of cell M_1 (that section of vein M_{1+2} just beyond the r-m crossvein) is about equal, to just slighty longer than, the r-m crossvein. The cubital cell is just slightly narrowed at the apex. *Abdomen*: Rather thickly black pilose and brownish pubescent. *Genitalia*: Very conspicuous, strongly forcipate, equal in length to the seventh and eighth abdominal segments. The ninth tergum is developed into a pair of long incurved lobes on the hind margin. These lobes are three times longer than the remainder of the tergum and extend about half again beyond the apices of the ninth sternum. The lobes of the tergum are sharply pointed at their apices and are joined at bases by a narrow sclerotized bridge. (fig. 12a). The ninth sternum is about two times wider than long. The posterior margin terminates in a sharp pointed spine, on each side. This spine is approximately equal in length to the clasping structures (fig. 12c). From a lateral view the spine-like lobe extends about one-half the length of the apical lobes of the tergum (fig. 12b). The posterior median margin of the sternum possesses three obtuse lobes, one just inside each clasper, and one median lobe. The claspers are enlarged at apices and each has a subapical, truncate, beak-like process on the outer margin (fig. 12c).

Length: body, 3.5 mm.; wings, 4.0 mm.

Female unknown.

Holotype male: Mitomoni, 700-1100 m., Nyassa-See, Randberge o.v. Mbanba-Bai, 10.-18.IV. 36 (Zerny). Four male paratypes, same data as type.

Type returned to the Naturhistorisches Museum, Wien, Austria. One paratype has been deposited in the United States National Museum and one is in the University of Hawaii collection.

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A STUDY OF THE MEMBRACID GENUS CENTRODONTUS (Homoptera).

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This paper presents the results of a study of the Membracid genus *Centrodontus*. The genus is apparently confined to North American desert areas and has been studied throughout its known distribution so far as material was available.

Genus *Centrodontus* Goding

1892 *Centrodontus* Goding, Ent. News 3:201.
1892 *Centrodontus*, Goding, Trans. Amer. Ent. Soc., 19:253.
1895 *Tuberculocentrus* Goding, Canad. Ent., 27:275.
1903 *Tuberculocentrus*, Buckton, A Monograph of the Membracidae, p. 271.
1908 *Centrodontus*, Van Duzee, Bull. Buffalo Soc. Nat. Sci., 9:110, 116.
1916 *Centrodontus*, Van Duzee, Check List of the Hemiptera of America North of Mexico, p. 63.
1916 *Tuberculocentrus*, Van Duzee, Check List of the Hemiptera of America North of Mexico, p. 63.
1917 *Centrodontus*, Van Duzee, Catalogue of the Hemiptera of America North of Mexico, p. 565.
1917 *Tuberculocentrus*, Van Duzee, Catalogue of the Hemiptera of America North of Mexico, p. 567.
1927 *Centrodontus*, Funkhouser, General Catalogue of the Hemiptera, Fascicle I, Membracidae, p. 357.
1927 *Tuberculocentrus*, Funkhouser, General Catalogue of the Hemiptera, Fascicle I, Membracidae, p. 506.
1951 *Centrodontus*, Funkhouser, Genera Insectorum, Fascicle 208, Family Membracidae, p. 172.

Type species of *Centrodontus: Gargara atlas* Goding (original designation).

Type species of *Tuberculocentrus: Tuberculocentrus solus* Goding (monobasic).

Dorsal Aspect: Greatest width of head excluding eyes about 6 times medial length; cephalic margins of head and pronotum nearly parallel, usually slightly diverging laterally; ocelli protruding very little or not at all, closer to eyes than to each other; pronotum anteriorly almost as wide as head at outer margins of eyes, abruptly expanded at humeri to wider than head; posterior pronotal process gradually narrowing from base to apex; median carina distinct.

Lateral Aspect: Tegmina extending only slightly caudad of abdomen, extending caudad of posterior pronotal process by more than a third of their length; basal fourth of tegmen punctate; pronotum forming a large gibbosity above humeri; usually an abrupt protuberance near middle of posterior process, and another much smaller one at apex.

Color: Largely brown in female, brown or black in male; head usually same color as pronotum in female, variable in male.

* Contribution No. 788 from the Department of Entomology, University of Kansas.

Distribution: Arid regions of the southwestern United States and at least northern Mexico.

Centrodontus atlas (Goding)

The only known species of the genus, *C. atlas,* is widespread in the Southwest and has been divided into three subspecies, as shown subsequently. The synonymy is indicated under the subspecies.

Posterior pronotal process gradually narrowing from base to position of middle protuberance where it usually widens slightly, abruptly narrowing at apex; anterior pronotal gibbosity usually with a secondary protuberance on its caudal slope; tegmen usually subhyaline, venation variable in density but prominent, with a yellow or light brown spot near base; tibiae variable, usually having three straw and three brown or black areas, varying to uniform straw, brown, or black.

Male Genitalia: In ventral view, subgenital plate broadest near base, narrowest at middle, obovate beyond middle; in lateral view apical third of subgenital plate ventrally convex; gonoforceps extending cephalad of base of subgenital plate, widest at middle, narrowing caudad, abruptly widened before apex; posterior arm of aedeagus about six times as long as width at middle, in lateral view widened near middle and gradually narrowing to acute apex; in ventral view posterior arm approximately parallel-sided, usually narrowing slightly toward base, slightly widened before bluntly-rounded apex; tooth of lateral valve about as long as basal width, apex acute and usually curved ventrad.

Host: Larrea tridentata Cav. (Creosote Bush, Greasewood).

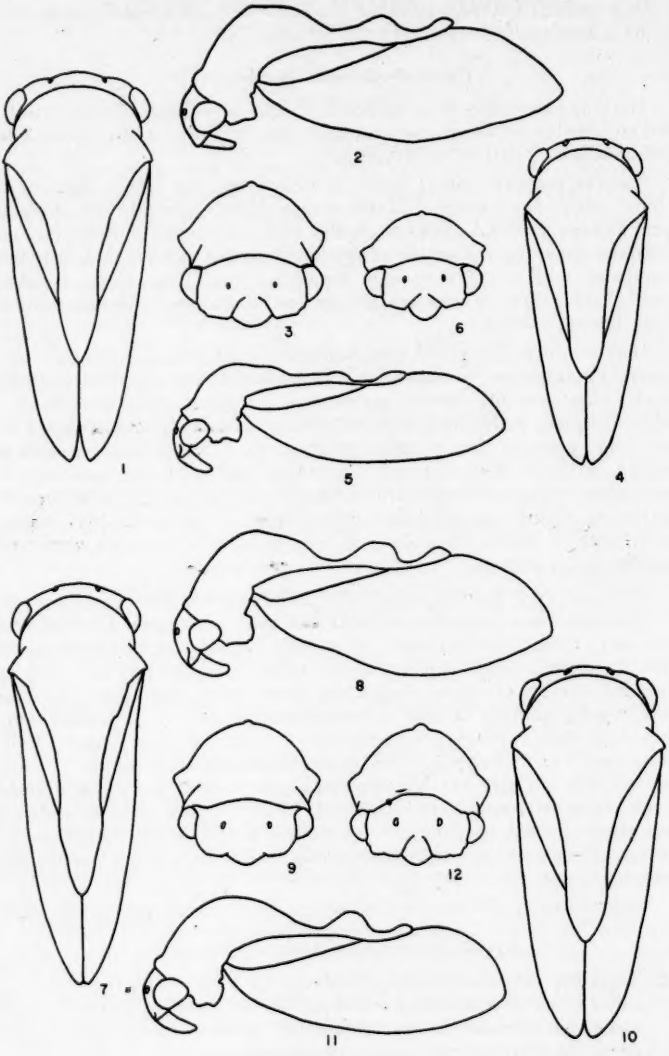
Centrodontus atlas is here divided into three subspecies: *Centrodontus atlas atlas, C. atlas paucivenosus,* and *C. atlas reticulatus.* All subspecies are known only from North American desert areas, and apparently occur only on *Larrea tridentata* (Creosote Bush), the desert index plant. The subspecies may be geographically divided in the following manner. *C. a. paucivenosus,* the eastern form, is roughly separable from *C. a. atlas,* the northwestern form, along the Colorado River. *C. a. reticulatus* is confined to the region of the Imperial Valley of California. Morphologically, *reticulatus* is at one end of the series and *paucivenosus* at the other end. Thus, *C. a. paucivenosus* and *C. a. reticulatus* are strikingly distinct, but there is a more or less complete series of intergrades from one to the other through *C. a. atlas* which is intermediate morphologically.

Approximately 950 specimens of the species were examined in this study.

Key to Subspecies of Centrodontus atlas

1a. Tegminal venation densely reticulate (fig. 30); usually with a dull appearance; middle pronotal protuberance small or absent, and no protuberance at apex of posterior process; anterior pronotal gibbosity convex, the secondary protuberance on its caudal slope reduced and sometimes absent ..... *atlas reticulatus.*

1b. Tegminal venation less dense; usually with a shiny appearance; middle pronotal protuberance usually prominent, sometimes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greatly reduced in ♂; a small protuberance at apex of posterior pronotal process, sometimes absent in ♂; secondary proturbance on anterior pronotal gibbosity well defined ..... 2.

2a. Tegminal venation sparse (fig. 28 and 29), cells deeply concave; usually with glazed appearance; middle pronotal protuberance prominent, small apical protuberance of posterior process well developed except in a few males ..... *atlas paucivenosus.*

2b. Tegminal venation moderately reticulate (fig. 24 and 26), less dense in ♂, cells often concave; usually shiny in appearance; middle pronotal protuberance moderately prominent in ♀, usually reduced in ♂; apical protuberance of posterior process reduced, usually absent in males ..... *atlas atlas.*

Centrodontus atlas atlas (Goding)

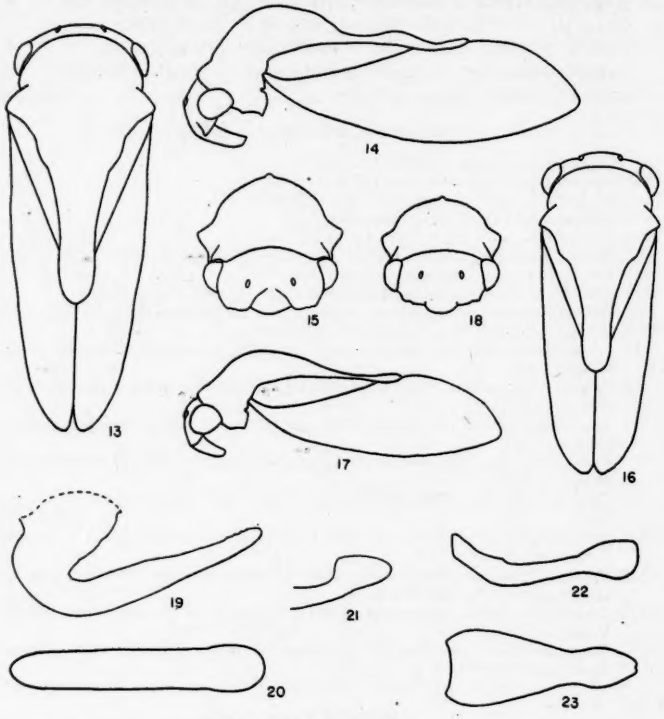
1892 *Gargara atlas* Goding, Ent. News 3:110.
1892 *Gargara atlas,* Townsend, Canad. Ent., 24:196.
1892 *Centrodontus atlas,* Goding, Ent. News 3:201.
1892 *Centrodontus atlas,* Goding, Insect Life 5:92.
1893 *Centrodontus atlas,* Riley, N. A. Fauna 7:250.
1894 *Centrodontus atlas,* Goding, Bull. Ill. State Lab. Nat. Hist., 3:474.
1895 *Tuberculocentrus solus* Goding, Canad. Ent., 27:276.
1903 *Centrodontus atlas,* Buckton, Monograph of the Membracidae, p. 266.
1903 *Tuberculocentrus solus,* Buckton, Monograph of the Membracidae, p. 271.
1908 *Centrodontus atlas,* Van Duzee, Bull. Buffalo Soc. Nat. Sci., 9:116.
1916 *Centrodontus atlas,* Van Duzee, Check List of the Hemiptera of America North of Mexico, p. 63.
1916 *Tuberculocentrus solus,* Van Duzee, Check List of the Hemiptera of America North of Mexico, p. 63.
1917 *Centrodontus atlas,* Van Duzee, Catalogue of the Hemiptera of America North of Mexico, p. 565.
1917 *Tuberculocentrus solus,* Van Duzee, Catalogue of the Hemiptera of America North of Mexico, p. 567.
1917 *Centrodontus atlas,* Funkhouser, Cornell Univ. Agr. Exp. Sta. Memoir 11. pl. 31, fig. 8.
1923 *Multareis planifrons* Van Duzee, Proc. Calif. Acad. Sci., (4) 12:170. (♀ allotype and ♀ paratypes only.)
1927 *Multareis planifrons,* Funkhouser, General Catalogue of the Hemiptera, Fascicle 1, Membracidae, p. 56. (Females.)
1927 *Centrodontus atlas,* Funkhouser, General Catalogue of the Hemiptera, Fascicle 1, Membracidae, p. 357.
1927 *Tuberculocentrus solus,* Funkhouser, General Catalogue of the Hemiptera, Fascicle 1, Membracidae, p. 506.

Explanation of Figures 1 to 12.

1. *Centrodontus atlas atlas* Goding ♀ Dorsal view.
2. *Centrodontus atlas atlas* Goding ♀ Lateral view.
3. *Centrodontus atlas atlas* Goding ♀ Cephalic view.
4. *Centrodontus atlas atlas* Goding ♂ Dorsal view.
5. *Centrodontus atlas atlas* Goding ♂ Lateral view.
6. *Centrodontus atlas atlas* Goding ♂ Cephalic view.
7. *Centrodontus atlas paucivenosus* n. subsp. ♀ Dorsal view.
8. *Centrodontus atlas paucivenosus* n. subsp. ♀ Lateral view.
9. *Centrodontus atlas paucivenosus* n. subsp. ♀ Cephalic view.
10. *Centrodontus atlas paucivenosus* n. subsp. ♂ Dorsal view.
11. *Centrodontus atlas paucivenosus* n. subsp. ♂ Lateral view.
12. *Centrodontus atlas paucivenosus* n .subsp. ♂ Cephalic view.

1943 *Multareis planifrons,* Funkhouser, Bull. Brook. Ent. Soc., 37:166. (Females only?)
1951 *Centrodontus atlas,* Funkhouser, Genera Insectorum, Fascicle 208, Family Membracidae, p. 173.
1951 *Centrodontus solus,* Funkhouser, Genera Insectorum, Fascicle 208, Family Membracidae, p. 173.
1951 *Multareis planifrons,* Funkhouser, Genera Insectorum, Fascicle 208, Family Membracidae, p. 58. (Females.)

This species was described in 1892 from a series of males from Kern County, California; later (1895) it was redescribed as *Tuberculocentrus solus*



Explanation of Figures 13 to 23.

13. *Centrodontus atlas reticulatus* n. subsp. ♀ Dorsal view.
14. *Centrodontus atlas reticulatus* n. subsp. ♀ Lateral view.
15. *Centrodontus atlas reticulatus* n. subsp. ♀ Cephalic view.
16. *Centrodontus atlas reticulatus* n. subsp. ♂ Dorsal view.
17. *Centrodontus atlas reticulatus* n. subsp. ♂ Lateral view.
18. *Centrodontus atlas reticulatus* n. subsp. ♂ Cephalic view.
19. *Centrodontus atlas paucivenosus* n. subsp. ♂ Aedeagus, lateral view.
20. *Centrodontus atlas paucivenosus* n. subsp. ♂ Aedeagus, ventral view.
21. *Centrodontus atlas paucivenosus* n. subsp. ♂ Apex of gonoforceps.
22. *Centrodontus atlas paucivenosus* n. subsp. ♂ Subgenital plate, lateral view.
23. *Centrodontus atlas paucivenosus* n. subsp. ♂ Subgenital plate, ventral view.

from a series of both sexes from Death Valley, California. Van Duzee's (1923) allotype and female paratypes of *Multareis planifrons* are intermediate between the subspecies *Centrodontus atlas atlas* and *C. atlas paucivenosus;* his holotype male is a valid species of the genus *Multareis.*

Goding stated in his description of *G. atlas* that it was based upon "a pair" of specimens from the United States National Museum. Miss Louise M. Russell of the Division of Insect Identification, United States Department of Agriculture, has informed me that the series of specimens (of which Goding apparently was sent two) contains no females and that there are two male cotypes in the Museum (one covered with mold). The one good male cotype has been examined by the author and is here designated a lectotype.

In 1895 Goding described *Tuberculocentrus solus,* n. gen., n. sp. The author has examined two males and two females (the latter appearing teneral) of the series from which *T. solus* was apparently described, one female of which was compared with the type by Miss Russell. The females are the same as *C. atlas atlas,* while the males tend toward *C. atlas reticulatus.*

	Female	*Male*
Length:	3.5 to 4 mm.	2.8 to 3.3 mm.
Width:	1.3 to 1.5 mm.	1.2 to 1.3 mm.
Tegmen Length:	3 to 3.2 mm.	2.3 to 2.7 mm.

Median carina of pronotum distinct to caudad of middle pronotal protuberance, often moderately high on anterior pronotal gibbosity in female; veins prominent and moderately reticulate, cells often concave, but less so than in C. atlas paucivenosus; veins moderately prominent and less dense in male; secondary protuberance of anterior gibbosity prominent in female, often greatly reduced in male; apical protuberance of posterior process usually reduced in both sexes, often absent in male.

Color: Head of male usually darker than pronotum, often black, pronotum typically darkest near cephalic margin; head of female of same color as pronotum, pronotum of nearly uniform color; tibiae usually with three straw areas, often entirely straw in male; femora darker than tibiae, often nearly black; tegmen with a yellow spot near base, which is nearly white in some males.

Distribution: Extreme southwestern Utah, southern Nevada, southern California, and Baja California.

Lectotype ♂, cotype ♂: Kern County, California. (Probably the southeastern corner of the county, as *Larrea* does not occur in other parts.)

Neoallotype ♀: Mojave, California, July 7, 1933 (R. H. Beamer).

Parallotypes, all ♀ ♀: 8, Mojave, California, July 7, 1933 (R. H. Beamer).

Lectotype and cotype in the United States National Museum, Washington, D. C.; neoallotype and 6 parallotypes in the Snow Entomological Collections; 2 parallotypes in the author's collection.

Centrodontus atlas paucivenosus n. subsp.

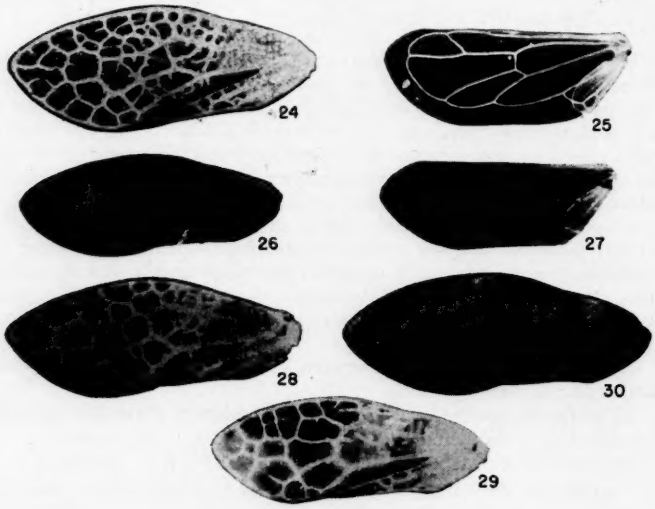
Similar to *Centrodontus atlas atlas* but veins of tegmina usually more prominent and fewer in number; protuberances of posterior process larger.

	Female	*Male*
Length:	3.6 to 4.3 mm.	3 to 3.3 mm.
Width:	1.3 to 1.7 mm.	1.2 to 1.5 mm.
Tegmen Length:	3 to 3.3 mm.	2.5 to 2.8 mm.

Median carina of pronotum usually more prominent than in *C. atlas atlas;* secondary protuberance of anterior pronotal gibbosity often less prominent than in *C. a. atlas,* middle protuberance of posterior process usually larger; caudal protuberance usually prominent, sometimes reduced in male; veins of tegmina very prominent, and typically sparse except along costal margin; cells deeply concave.

Color: Prothorax nearly uniform, the anterior gibbosity somewhat lighter dorsally; general appearance brown in females, dark brown to black in males; more hyaline area on costal margin of tegmen about two-thirds distance from base to apex; straw spots on tibiae vary from three to none, sometimes entirely straw; tegmen with a yellow spot near base, which is nearly white in some males.

Distribution: Southern New Mexico, Arizona (except northwestern and extreme southwestern), and Baja California.



Explanation of Figures 24 to 30.

24. *Centrodontus atlas atlas* Goding ♀ Left forewing.
25. *Centrodontus atlas atlas* Goding ♀ Left hindwing.
26. *Centrodontus atlas atlas* Goding ♂ Left forewing.
27. *Centrodontus atlas atlas* Goding ♂ Left hindwing.
28. *Centrodontus atlas paucivenosus* n. subsp. ♀ Left forewing.
29. *Centrodontus atlas paucivenosus* n. subsp. ♂ Left forewing.
30. *Centrodontus atlas reticulatus* n. subsp. ♀ Left forewing.

Holotype ♀ : Tucson, Arizona, July 14, 1950 (Paul P. Cook).

Allotype ♂ : Tucson, Arizona, August 31, 1929 (E. D. Ball).

Paratypes: 1 ♂, Tucson, Arizona, May 19, 1929 (E. D. Ball); 1 ♀ and 1 ♂, Tucson, Arizona, June 18, 1933 (P. W. Oman); 4 ♀ ♀, Tucson, Arizona, July 8, 1939 (Owen Bryant); 2 ♂ ♂, Tucson, Arizona, August 31, 1929 (E. D. Ball); 1 ♂, Tucson, Arizona, May 21, 1907 (F. C. Pratt); 2 ♀ ♀, Tucson, Arizona, July 14, 1950 (Paul P. Cook); 1 ♀, Tucson, Arizona, August 16, 1935 (Jack Beamer); 3 ♀ ♀, Tucson Mts., Arizona, June 18, 1933 (R. H. Beamer); 5 ♀ ♀, Casa Grande, Arizona, July 6, 1950 (Paul P. Cook); 2 ♀ ♀, Sabino Canyon, Arizona, July 31, 1941 (L. H. Banker); 3 ♂ ♂, Santa Catalina Mts., Arizona, May 8, 1933 (Owen Bryant); 8 ♀ ♀, Red Rock, Arizona, June 28, 1933 (P. W. Oman); 28 ♀ ♀, Wickenburg, Arizona, July 5, 1950 (Paul P. Cook); 3 ♀ ♀, Douglas, Arizona, July 19, 1950 (Paul P. Cook); 3 ♀ ♀, Vail, Arizona, August 18, 1935 (Jean Russell); 2 ♀ ♀, Santa Rita Mts., Arizona, August 1, 1941 (R. H. Beamer); 1 ♂, Picacho, Arizona, May 1, 1942 (Owen Bryant); 2 ♀ ♀, Lowell Ranger Station, Pima Co., Arizona, July 6-20, 1916; 1 ♀, Sta. Cruz Village, Cobabi Mts., Arizona, August 10-12, 1916; 5 ♂ ♂, Rodeo, New Mexico, June 8, 1933 (P. W. Oman).

Holotype in the Snow Entomological Collections.

Allotype in the United States National Museum.

Paratypes: 5 ♂ ♂ and 6 ♀ ♀ in the United States National Museum; 1 ♂ and 35 ♀ ♀ in the Snow Entomological Collections; 2 ♂ ♂ and 2 ♀ ♀ in the collection of R. A. Flock, Riverside, California; 2 ♀ ♀ in the American Museum of Natural History; 7 ♂ ♂ and 19 ♀ ♀ in the author's collection.

Centrodontus atlas reticulatus n. subsp.:

Similar to *Centrodontus atlas atlas* but venation more reticulate and protuberances of posterior pronotal process smaller or absent.

	Female	*Male*
Length:	3.5 to 4 mm.	3 to 3.3 mm.
Width:	1.3 to 1.5 mm.	1.2 to 1.3 mm.
Tegmen Length:	2.7 to 3 mm.	2.3 to 2.7 mm.

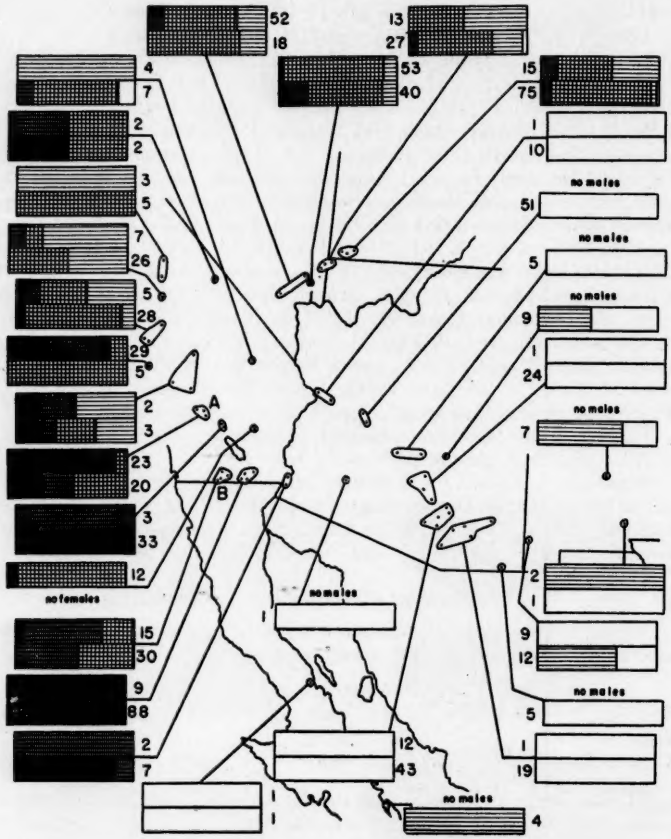
Median carina of pronotum less distinct than in *C. atlas atlas* or absent; anterior pronotal gibbosity usually not as large as in *C. a. atlas*, its secondary protuberance faint in female, nearly or entirely indistinguishable in male; second protuberance very small or absent, third protuberance typically absent; tegmen slightly hyaline or opaque; veins only moderately prominent, more densely reticulate than in other subspecies.

Color: Generally darker than other subspecies; straw and brown areas of tibiae less distinct or tibiae uniform in color; femora usually of same color as tibiae in female, darker in male; tegmen with a lighter brown spot near base, which is rarely light yellow.

Distribution: The Imperial Valley of (southern) California, and the extreme southwestern corner of Arizona.

Holotype ♀ : East of Holtville, California, June 1, 1935 (P. W. Oman).

Allotype ♂ : 3.7 mi. North Mt. Signal, California, May 4, 1949 (R. C. Dickson).



Explanation of Figure 31.

A map showing the known distribution of the subspecies of *Centrodontus atlas*. Individuals were placed in one of five classes according to the coarseness of the reticulation of the tegminal venation. Rectangles are connected to the various localities or groups of localities by lines, and indicate the classes of specimens from each area. The rectangles are divided horizontally, the upper halves representing males, the lower halves females. The horizontal length of a rectangle represents 100% of the individuals. Where various classes occur in one area the length is subdivided to show the percentage of individuals of each class in the area. White indicates the coarsest reticulation, typical of the subspecies *pauci-venosus* (fig. 28 and 29). Horizontal lines indicate slightly finer reticulation. Square cross-hatching represents still finer reticulation, typical of the subspecies atlas (fig. 24 and 26). Small rectangular cross-hatching represents even finer reticulation, and black represents the finest reticulation, characteristic of the subspecies *reticulatus* (fig. 30). Thus, in area A, 30% of the females were most finely reticulate, 25% were slightly coarser, and 45% were as coarse as in the subspecies *atlas*. The numbers beside the rectangles indicate the number of individuals of each sex from each area. The variation of other characters, such as the pronotal protuberances, closely parallels the variation in reticulation of the tegmen.

Paratypes: 2 ♀ ♀ and 2 ♂ ♂, 3.7 mi. North Mt. Signal, California, May 4, 1949 (R. C. Dickson); 3 ♀ ♀ and 1 ♂, Edom, California, March 28, 1936 (P. H. Timberlake); 24 ♀ ♀, East of Holtville, California, June 1, 1935 (P. W. Oman); 10 ♀ ♀, El Centro, California, June 1, 1935 (P. W. Oman); 2 ♀ ♀, Calexico, California, June 18, 1909 (E. D. Ball).

Holotype, allotype, and 21 ♀ ♀ paratypes in the United States National Museum; 2 ♂ ♂ and 6 ♀ ♀ paratypes in the collection of R. A. Flock; 2 ♀ ♀ paratypes in the Snow Entomological Collections; 1 ♂ and 12 ♀ ♀ paratypes in the author's collection.

Geographical Variation

The separation of the subspecies can be based at least partially on altitude. *C. a. reticulatus* is restricted to areas of very low altitude, occurring in the Imperial Valley which is largely below sea level and at least as far east as Yuma, Arizona, which is approximately 150 feet above sea level. *C. a. atlas* is in general from higher altitudes than *C. a. reticulatus,* occurring approximately between 200 and 2,000 feet elevation. *C. a. paucivenosus* occurs in the higher desert altitudes, from approximately 2,000 to 4,000 feet except that meager material indicates that it occurs at 500 to 1,000 feet in Baja California.

One specimen from Death Valley, California, also a low area, resembles *C. a. reticulatus* (but appears much closer to *C. a. atlas*). Palm Springs, California, (fig. 31, area A) is a locality where there occurs an abrupt change in altitude and it is interesting to note that the specimens from Palm Springs vary almost imperceptibly from *C. a. atlas* to *C. a. reticulatus;* no data are available as to the altitudes at which the specimens were taken. Another locality of some interest is Painted Gorge, (fig. 31, area B) which is about twenty miles west of El Centro, California, in the Imperial Valley. The female specimens of this series appear closer to *C. a. atlas,* but the males are intermediate or closer to *C. a. reticulatus* and have coloring more like *C. a. paucivenosus.* The elevation at Painted Gorge is about 140 feet. Also worthy of mention is the occurrence of a few specimens intermediate or closer to *C. a. reticulatus* as far north as Overton, Nevada. The last, however, appear to follow the Colorado River, which is through most of its course in a canyon of considerably less elevation than the surrounding areas. Specimens from Las Cruces, New Mexico, belong to *C. a. paucivenosus,* but tend toward *C. a. atlas.* This seems to fit well with what is known regarding elevation; specimens considered typical *C. a. paucivenosus* occur in Arizona, which is for the most part of higher elevation than Las Cruces.

The intergradation between the subspecies seems rather peculiar. The females alone form a reasonably understandable series. The males of the three subspecies as they are understood at the time of this writing seem clearly definable, but show an intergradation which closely parallels but is not the same as that of the females. An example is that of Painted Gorge cited above.

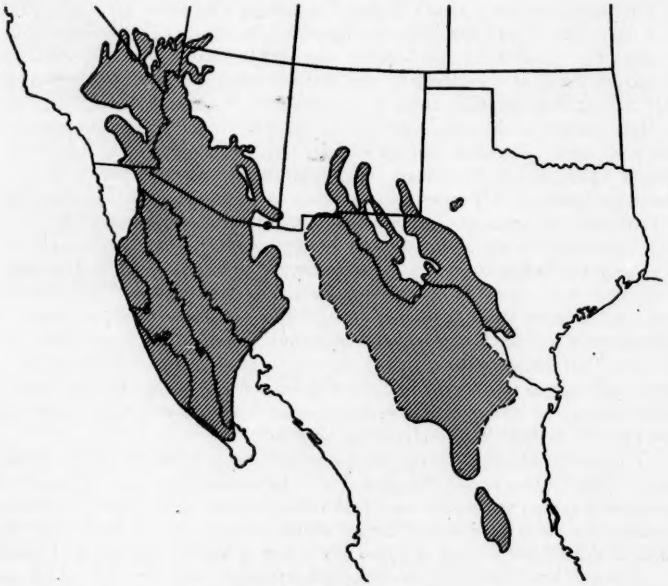
A few other specimens merit special attention. Two females which are typical *C. a. paucivenosus* are labeled San Diego, California. This is almost undoubtedly a mistake in labeling, as the host plant, *Larrea tridentata,* does not occur there. Possibly San Diego County is intended, as *Larrea* occurs in

its eastern part although *paucivenosus* does not occur there. There are four females from El Paso, Texas, which are typical *C. a. paucivenosus* except that they are of a peculiar opaque yellow color. These are the only examples of *Centrodontus* from Texas that the author has seen.

Only six specimens of *Centrodontus* from Mexico have been examined, all from Baja California. The four from Concepcion Bay (in the southern half of the peninsula) are those mentioned above which Van Duzee described as females of *Multareis planifrons*. They are intermediate between *C. a. atlas* and *C. a. paucivenosus*, but seem closer to the latter. Two specimens from Bahia de los Angeles represent *C. a. paucivenosus*. There is insufficient material available to allow any conclusion as to the distribution of *Centrodontus* in Baja California other than the fact that the genus is represented there by known subspecies.

ACKNOWLEDGEMENTS

The author wishes to express thanks to Dr. Paul B. Lawson and Dr. C. D. Michener for their kind help in the preparation of this paper, to Miss Louise M. Russell for comparing specimens with types and for lending valuable material, to Dr. R. A. Flock for lending valuable material and for supplying information on localities, to Dr. R. C. Dickson of the University of California



Explanation of Figure 32.

A map (modified from Shreve, 1931) showing the distribution of the host plant, *Larrea tridentata* Cav.

for locality information; to Dr. Ivan M. Johnston of the Arnold Arboretum, Harvard University for information on the host plant; and to the following for lending specimens: Dr. E. S. Ross and Hugh B. Leech of the California Academy of Sciences; Dr. Roland Fischer and Dr. E. F. Cook of the University of Minnesota; and Dr. Mont A. Cazier of the American Museum of Natural History.

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MATURITY OF CORN AND LIFE HISTORY OF THE ANGOUMOIS GRAIN MOTH [1, 2, 3]

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Avoidance of an infestation should always be considered in controlling the Angoumois grain moth. Since infestation originates either in the crib or is brought in with grain infested in the field, it is of critical importance to know what stage of development grains become susceptible to infestation. To determine this point a careful rechecking of life history and some work on field infestation was considered necessary.

This is a summary of life history studies conducted in 1951 at the University of Arkansas. The detail of rearing work was carried on in a first floor room with cross ventilation. The field work was conducted at the Station Farm.

A large number of articles concerning the Angoumois grain moth have been published. The life history of this species has been studied and reported upon in considerable detail by King (1) and by Simmons and Ellington (2). The importance of field infestation has been stressed by Cartwright (3) and by Redlinger and Wilson (4).

REARING METHODS

In this study corn (Hybrid - Mo. No. 8) was used for rearing. Newly emerged males and females were paired and placed in vials for oviposition records. Immediately after placing the adults in the vial, two pieces of dark cardboard were inserted for egg deposition. The cardboards were fastened

[1] Sitotroga cerealella (Olivier): Order Lepidoptera, Family Gelechiidae

[2] This paper is based on a master's thesis in entomology.

[3] The writer wishes to acknowledge assignment of this problem and suggestions throughout the course of study by Dwight Isley, Professor of Entomology.

Research paper No. 1049, Jour. series, Univ. of Ark. Published with the permission of the Director of the Experiment Station.

together with a paper clip and so shaped as to fit in the life-history vial loosely and to permit removal and introduction without injuring the adult moths. The incubation period was determined by taking a known number of eggs deposited on the same day, grouping them together, and recording the date and number hatched.

In order to determine the duration of the combined larval-pupal stage, known numbers of newly hatched larvae were placed in jelly glasses which were partly filled with shelled corn. The glasses were covered with muslin held secure with a rubber band, and observed daily for emergence of the adults. After emergence began the adults were removed three times daily so as to prevent reproduction. In no case did a second generation appear.

RESULTS

One hundred female moths deposited an average of 155 eggs each. This compares with about 40 as reported by previous workers. The maximum number for any individual was 255 eggs. Eighty seven per cent of these eggs were deposited during the first four days after emergence. The mean temperature during the oviposition period was 80 degrees F.

The incubation period for 2,077 eggs of the Angoumois grain moth varied from four to eight days, with a mean of 5.23 days. Adults may mate immediately after emergence. The preoviposition period was sometimes less than 24 hours.

The minimum duration of the larval-pupal period when reared from mature corn was 26 days. The average duration for 87 individuals was 36 days. The percentage of survival was only 22 per cent, which was probably due to the hardness and dryness of the corn.

Immature corn at different stages of maturity was also used for rearing to determine if this would alter the duration of the larval-pupal stage. The field from which the corn was selected was planted on April 19, 1951, and was a hybrid (Mo. No. 8). On July 9, 1951, the first silks were noticed in the field. On July 11 it was estimated that 10 per cent of the silks had appeared. An ear of corn was taken from the field for six successive weeks, beginning July 21, 1951. A portion of the ear, approximately 1½ inches long, was husked and placed in a jelly glass (3 x 2 inches in dimension) and infested with 50 newly hatched larvae. The first infestation was made on July 21, 1951. At this time the grains contained only a milky liquid and were about one-third the size of mature grains.

The minimum duration for the larval-pupal stage when reared from immature corn was 20 days, or 6 days less than when reared from mature corn. The average duration of the larval-pupal stage for 122 individuals of the six successive infestations was 28 days. The percentage of newly hatched larvae that became adults ranged from 32 to 60 per cent. The mean temperature during this period was 80 degrees F. In general, the duration of the larval-pupal stage was shorter when reared from corn in the early stage of maturity, but the percentage of survival was higher when reared from more mature corn. In all cases the percentage of survival was higher than when reared from stored corn. The shortest duration for the larval-pupal period previously reported was 29 days (2). Rearing in this instance was from newly harvested wheat.

FIELD INFESTATION

Newly hatched larvae of the Angoumois grain moth were caged on ears of corn in the field at different stages of maturity to determine if they could survive. This should also give some indication as to the stage of maturity at which corn is susceptible to attack. Fifty larvae were placed on one ear of corn at weekly intervals for five successive weeks. The husk over the tip of the ear was pulled back approximately two inches on one side of the ear. The ear was then covered with a canvas sack and left in the field for 18 days after which it was brought to the building used for rearing and observed for moth emergence. The same field of corn as described earlier was used. The first infestation was made on July 25, 1952. At this time small grains were present on the ear but contained only a milky liquid. At the time of the last infestation the husks on the ear were beginning to turn brown, but the corn was not dry enough for ordinary storage.

No larvae survived from the first infestation. Eight percent survival resulted from the second infestation which was made when corn was in the roasting-ear stage. The percentage of survival increased with each weekly infestation, 62 per cent survival being recorded from the fifth, or last, infestation. The rate of development was not as rapid here as where the immature corn was held in the building during the entire period. The minimum time recorded for development of the larval-pupal stage was 24 days. The mean temperature in the field during this period was 78 degrees F.

SUMMARY

The life cycle of the Angoumois grain moth, from egg to adult, may be completed in as short a period as 24 days. Adults may mate immediately after emergence. The preoviposition period is sometimes less than 24 hours. An average of 155 eggs was deposited by each female. The average incubation period was 5.23 days.

The shortest duration recorded for the combined larval-pupal stage was 20 days. In this instance rearing was from immature corn. The shortest period recorded when reared from mature corn was 26 days which is shorter than any previous record.

It was established that newly hatched larvae can survive when placed on immature corn in the field. Eight per cent survival was recorded when corn was infested while in the roasting-ear stage. The percentage of survival increased as the corn became more mature. It is obvious that corn in the roasting-ear stage is subject to infestation. These early field infestations may be important in carrying the species from one crop to the next.

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DISTRIBUTIONAL AND SYNONYMICAL DATA AND DESCRIPTIONS OF TWO NEW HYDROMETRA

(Hemiptera: Hydrometridae).

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Ames, Ia.

The present paper contains notes on 11 species of North American marsh-treaders of the genus *Hydrometra* Lamarck, including two Mexican species described as new. An attempt is made to straighten out the confusion and synonymy of the first hydrometrid and its variety described from the Americas. The types of the new species are in the collection of C. J. Drake; paratypes in collection of both authors.

Hydrometra lentipes Champion

Hydrometra lentipes Champion, Biol. Centr.-Amer., Rhynch., 2:124. 1898.
Hydrometra cordubense Bueno, Entom. Amer., 7 (N.S. 2):121. 1926. (New Synonymy).
Hydrometra cordubense Hungerford, Ann. Mus. Nat. Hung., 28:101, pl. 11. 1934.

An examination of the type (U.S.N.M.), paratypes and other specimens determined by Bueno shows that *T. cordubense* Bueno is inseparable and synonymous with *H. lentipes* Champ. (New synonymy). Specimens are at hand from Mexico (Cuidad Valles, Aug. 8, 1951; Acapulco, Aug. 3, 1951; Alvarado, July 28, 1951; Puebla, July 30, 1950; Teziutlan, July 27, 1950, all taken by the authors). Other specimens examined are from Guatemala and Mexico (Lower Calif.).

Hydrometra intonsa, sp. new

Brachypterous form: General color brownish with tergites (save last) fuscous-ferrugineous, smooth, shining; abdomen with a conspicuous white spot near the upper-front margin of each abdominal segment, beneath somewhat frosted.

Size: Length, 8.75 mm.

Head: Length, 2.65 mm. Anteocular part twice as long as postocular (60: 29). Interocular groove above shallow, not longer than an eye, groove beneath shallow, not extending beyond margins of eyes. Rostrum (pressed against underside of head) extending a little beyond middle of postocular part. Clypeus narrow, a little longer than wide, rounded in front. Antennae long, slender, brownish, the basal segment becoming a little thicker distally and apical three-fifths dark fuscous; formula—I, 46; II, 62; III, 200, IV, 124.

Thorax: Pronotum 1.40 mm. long, with the median longitudinal line feebly developed and not frosted, broadly constricted near the middle with deepest part just in front of the middle; front lobe slightly darker, with an encircling row of large pits near to and paralleling front margin, otherwise not pitted; hind lobe with numerous moderately large pits, one row on median line and numerous pits irregularly arranged on each side. Propleura pitted, pits arranged in two rows. Abbreviated hemelytra strap-like, subequal in length to pronotum, extending a little beyond hind acetabula; veins raised,

prominent, dark brown. All acetabula pitted; fore and middle acetabula each with ten pits, four in front of a cleft and six behind it; hind acetabula with six pits. Pits of propleura and acetabula moderately large, about equal in size. Legs long, slender, brownish testaceous; all coxae testaceous; front legs with femora not attaining apex of head, shorter than tibiae (210:240); hind legs with femora extending a little beyond tip of genital segments, a little longer than tibiae (300:360). Space between fore and middle coxae is to the space between middle and hind coxae as 58:90.

Abdomen: Length, 3.75 mm. Venter with only a few scattered long hairs; last segment of male beneath without brushes or other processes, with a few long hairs near the hind margin. First genital segment of male strongly roundly impressed beneath on each side near the base, the impressions deep, large, somewhat frosted at the bottom, each with numerous long hairs on upper part, the long hairs plainly visible on both sides from dorsal aspect; median part between ventral impressions ridge-like and not impressed. The last dorsal segment terminating behind in a pointed, slightly upright process. When viewed from above, the long hairs on sides of first genital segment and postero-lateral margins of last venter give the male a shaggy-like appearance.

Type (brachypterous male), Cuidad Victoria, Mex., taken in a small pond shallowly connected on one end with a small stream, Aug. 8, 1951, C. J. Drake.

This species belongs to the *H. lentipes* Champion group which have no spines, brushes or other processes on the last venter of the male. It is distinctly set-off from *H. lentipes* by having a much longer rostrum, lighter color and long hairs on the sides of first genital segment. The antennal formula is also different. The rostrum of *lentipes* does not extend beyond the hind margins of the eyes.

Hydrometra martini Kirkaldy

Hydrometra lineata Say, Heter. N. Harm., 1832, p. 35 (Preoc.).
Hydrometra lineata Martin, Can. Ent., 32:70, pl. 3. 1900.
Hydrometra martini Kirkaldy, Entomologist, 33, 1900, p. 175.
Hydrometra martini Bueno, Entom. Amer., 7(N.S. 2):110. 1926.
Hydrometra martini Hungerford, Ann. Mus. Hung., 28:105. 1934.

In 1832, Say described the first two hydrometrids from the Americas as *Hydrometra lineata* and variety *australis*. As the name *lineata* was preoccupied (*Hydrometra lineata* Eschscholtz from the Philippines), Kirkaldy (1900) proposed the name *martini* for Say's species. As the original description of Say's two forms are very brief and as the types are non-extant, the two commonest and most widely dispersed marsh-treaders in the United States have been much confused and even often treated as a single species under the name *H. martini*. The name *australis* Say remained just a querry for many years.

Hungerford (1923) published notes and illustrations of a Kansas species, which he considered to be the true *australis* Say. The latter species has acuminate processes on the last segment of the venter in the male, and thus differed greatly from the species commonly called *H. martini*, which has transverse, linear processes in the male.

In his studies of Hydrometridae of the New World, Bueno (1926) described the species determined as *australis* Say by Hungerford (1923) under

the name *H. hungerfordi* and then redescribed the same species from Georgia in the same article as *australis*. An examination of specimens determined by Bueno as *hungerfordi* and *australis* shows that these two names were given by him to the same species. In the same paper Bueno also described *H. myrae*, which was one of the two species commonly confused with *martini* in collections and published records.

H. martini Kirk. as delimited by both Bueno (1926) and Hungerford (1934) is common and widely distributed in United States and southern Canada. It has the second antennal segment twice as long as the first; the male processes on the last venter are linear and transverse, and it is undoubtedly the true *martini* Kirkaldy.

This paper proposes to make the species that was so long confused with *martini* (*H. myrae* Bueno, 1926) as the true *australis* Say. Although widely distributed in the United States, it is the commonest species in the Gulf States and extends its range deep into the West Indies, Mexico and Central America. This species has the second antennal segment two and one-half times as long as the first; the male processes, size and color are very similar to typical *martini*.

The above arrangement makes the two most closely related and most widely distributed hydrometrids, the two species described by Say and thus leaves *hungerfordi* Bueno as a valid species; *H. myrae* Bueno is here suppressed as a synonym of *H. australis* Say. In order to avoid further confusion, synonymic changes are indicated in the bibliography of the three species concerned.

Hydrometra australis Say

Hydrometra australis Say, Heter. N. Harm., 1832, p. 35 (as var. of *lineata*)
Hydrometra myrae Bueno, Entom. Amer., & (N.S. 2):110. 1926. (New Synonymy).
Hydrometra myrae Hungerford, Ann. Mus. Nat. Hung., 28:105. 1934.

This species fits very nicely Say's scant description of *var. australis*, and is the commonest species in Louisiana (type locality) and other Gulf States. Specimens were taken in Mexico (Tampico, July 16, 1950; Cuidad Valles, Aug. 17, 1950; and Acapulco, Aug. 3, 1951, all by the authors).

Hydrometra hungerfordi Bueno.

Hydrometra australis Hungerford, Can. Ent., 55:55. figs. 1923.
Hydrometra hungerfordi Bueno, Entom. Amer., 7(N.S. 2):107. 1926.
Hydrometra australis Bueno, Entom. Amer., 7(N. S. 2):117. 1926.

As stated under the two preceding species, *H. hungerfordi* Bueno is a valid species and not at all easily confounded with *H. australis* or *H. martini*. The male processes on last venter are spine-like and not transversely linear as in both of the species described by Say. In the paper (1926) cited above, Bueno's *australis* (not Say) is identical with the species which he described as *hungerfordi*.

Specimens of *H. hungerfordi* have been examined from Kansas, Mississippi, Florida and Georgia.

Hydrometra taxcana, sp. new

Moderately large, brown or darkish brown with appendages testaceous-brown; body beneath a little darker, slightly frosted.

Size: Length, 10.20-11.40 mm.

Head: Length, 3.35 mm. Anteocular part twice as long as postocular (168:84). Eyes reddish brown. Interocular groove above shallow, scarcely as long as an eye; groove beneath shallow, also not extending beyond margins of eyes. Rostrum very long, extending beyond middle of postocular part of head. Clypeus narrow, testaceous, nearly twice as long as wide, strongly obliquely narrowed on each side of apical two-fifths, terminating in a narrowly rounded, blunt point. Antennae long, slender, the basal segment enlarged and becoming a little darker apically; formula—I, 37; II, 80; III, 190; IV, 92.

Thorax (Macropterous form): Pronotum 1.80 mm. long, the median longitudinal line feebly developed, slightly frosted; anterior lobe with an encircling row of pits paralleling and setting-off a narrow front margin, otherwise unpitted, shorter than hind lobe (28:42); hind lobe wider than front lobe, with humeral angles feebly raised, pitted with numerous small pits (a row on impressed median line, another row on each side of this line, and then scattered and irregularly placed pits the rest of both sides of the hind lobe). There are two pits in front and two behind each cleft of both the fore and middle acetabula. Hemelytra extending to middle of penultimate tergite, pale brown, usually with a broken white line in the form of dashes or long spots on median part; veins raised, prominent, darker; In brachypterous form, hemelytra strap-like, nearly reaching to or barely extending on the basal segment of abdomen. Length of entire thorax, 3.10 mm.

Legs: Long, slender; anterior femora about attaining base of antennae; hind femora not reaching genital segments. *Length:* Fore femora, 2.75 mm.; middle femora, 3.00 mm.; hind femora, 3.80 mm.; hind tibia of each leg a little longer than its femur.

Abdomen: Length, 2.45 mm. Tergites (save last) smooth, shining, reddish fuscous.

Male: Last venter not smooth, impressed or flattened, beset with short spinules and roughened like other segments, with two dark, short, spine-like processes; processes erect, moderately separated, situated a little back of front margin of segment and not resting on tubercles or small swollen areas, not distinctly ridged between the processes, the distances between processes about three times as far as the distance from the anterior margin to a process. First genital segment beneath roundly deeply impressed on each side so as to leave a narrow median ridge, smooth within the impressed areas; second genital segment above terminating behind in a short, pointed, slightly upturned process.

Female: Generally a little longer and slightly stouter than male. Genital segment above terminating in a rather long, straight process with pointed tip.

Type (male) and *allotype* (female), Acapulco, Mex., taken in a large fresh-water pond, Aug. 3, 1951. *Paratypes:* 4 specimens, taken with the type; 1 specimen, Taxco, Mex., Aug. 1, 1951; 2 specimens, Puebla, Mex., July 20, 1951; 2 specimens, Guadalajara, Mex., Aug. 4, 1950 all by the authors; 3 specimens, Apatzingan, Michoacan, Mex., Aug. 15, 1941, H. Hoogstraal; and 7 specimens, San Marcus, Honduras, April 11, 1943, T. Aiken in U.S.N.M.

This species seems to be most closely allied to *H. hungerfordi* Bueno and may be separated from it by antennal formula (*taxcana*—I, 36; II, 80: *hunger-*

fordi—I, 32; II, 60) and position of male processes, which are placed farther from the front margin of the last venter. In both species, the encircling row of pits near the front margin of pronotum are not placed in a narrow circular impression and are not prominent. *H. cyprina* Bueno has the male processes farther apart and also placed farther from the anterior margin of last ventrite.

Hydrometra consimilis Barber

Hydrometra consimilis Barber, Amer. Mus. Novit., No. 75, 1934, p. 9.

Specimens are at hand from Mexico (Alvarado, July 28, 1951, Drake and Hottes), Cuba Soledad, Cienfuego, Aug. 2-12, 1934, P. J. Darlington), Jamaica (Ogho Rois, Aug. 20-24, 1934, P. J. Darlington), Porto Rico (Anasco District, July 3, 1917, Harold Morrison), Haiti (Dessalines, P. J. Darlington).

Hydrometra exilis Bueno

Hydrometra exilis Bueno, Entom. Amer., 7(N.S. 2):115. 1926.
Hydrometra whitei Hungerford, Journ. Kan. Ent. Soc., 7(2):142. 1933 (New Synonymy)

As the names *H. exilis* Bueno and *H. whitei* Hungerford apply to the same species, the latter is here placed in synonomy. Specimens have been examined from Mexico (Yucatan) and British Honduras (Punta Gordo, J. J. White).

Hydrometra wileyae Hungerford.

Hydrometra wileyi Hungerford, Can. Ent., 55:55, 5 figs. 1923.

Mexico (Acapulco, Aug. 3, 1951; Puebla, July 20, 1951; all collected by the authors). Numerous other specimens are at hand from Florida, Mississippi, Kansas and Texas.

Hydrometra zeteki Drake

Described from a long series of specimens taken in Panama. Several specimens were collected by the authors in a large fresh water pond near Acapulco, Mex. Aug. 3, 1951. Other specimens are at hand from Columbia, S. A. This species is confused in collection with *H. championiana* Bueno.

Hydrometra acapulcana Drake

Described from several specimens, collected in a salt water lagoon, near Acapulco, Mex., 1950. The authors found it in the same cove of the brackish lagoon and also in a large fresh water pond near Acapulco, Mex., Aug. 3, 1951. This species and *H. zeteki* Drake have been wrongly determined by Bueno as his *championiana.*

Bueno (1926) proposed the name *H. championiana* for the species Champion (1898) redescribed as *H. caraiba* Guerin. This proposal automatically makes the two Panamanian specimens in the British Museum the types of *championiana.* The writers here designate the short-winged male as the type and the long-winged female as the allotype of *championiana.* It should also be noted that the type of *H. naiades* Kirkaldy (1902) is the female described by Champion (1898) as *H. mensor* B.—White.

ONE OLD AND FIVE NEW SPECIES OF DELPHACINE FULGORIDS (Homoptera: Fulgoridae) [1, 2]

R. H. BEAMER
Lawrence, Kansas

1. *Sogata furcifera* (Horv.)

Delphax furcifera Horvath, Termes Futzetek, p. 372, 1899.

Macropterous form: Two longwinged males from Matzuyama, Japan are quite different from specimens from America determined by Muir and Giffard as this species. *Sogata furcifera* (Horv.) is here redescribed from these Japanese specimens.

Color: General ground color dark. Vertex, carinae of front, pronotum except large spot back of each eye and broad median band on meta and mesonotum light. Elytra whitish semi-hyaline except black mesal spot above apex of abdomen and portion of crossveins and apical veins infuscated.

Genitalia: In lateral view pygofer more or less rectangular, anterior ventral corner narrowed; style with caudal margin excavated, with caudodorsal corner extended sharply; aedeagus with sides almost parallel, gently curving dorso-caudally, apex sharp; anal segment with a pair of short heavy processes. In caudal view styles about twice as wide basally as at bifid apices, broadly excavated on outer margin, sharply and deeply excavated on outer third on inner margin, apices bifid with inner corner sharp and outer corner much broader; aedeagal brace quadrangularly excavated about half as deep as basal width, ventral margin of opening for styles with a knob-shaped projection.

Type in the Hungarian National Museum.

2. *Sogata meridiana* n. sp.

Macropterous form:

Resembling *Sogata furcifera* (Horv.) but usually lacking mesal black spot on clavus; bifid apices of styles almost as wide as base and processes on anal segment longer than segment and quite slender and sharp. Length, male 3.8 mm.; female 4.2 mm.

Color: General ground color stramineous to orange (orange portion often more or less infuscated) vertex pronotum and broad median longitudinal band of meso and metanotum almost white. Elytra, especially of males, on inner margin from crossveins to apices often infuscated.

Genitalia: In lateral view pygofer almost rectangular; styles with outer margin broadly excavated, and deeply bifid apices with outer point sharpest; aedeagus about as in *S. furcifera* with apex somewhat blunter; anal segment with a pair of long almost straight, sharp processes. In caudal view styles almost as wide across bifid apices as bases, inner point sharp and narrow, outer point about as broad as length of inner and twice as long; aedeagal brace U-

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[1] Contribution Number 798 from the Department of Entomology, University of Kansas, Lawrence.

[2] The illustrations for this paper were prepared with aid of funds from the University of Kansas General Research Appropriation.

shaped, more than twice as wide as deep, process lacking in base of style opening.

Holotype male, allotype female, Hibernia, Florida, August 7, 1939, R. H. Beamer; Paratypes: 1 male Hibernia, Florida, August 7, 1939, A. T. Hardy; 1 female same place and date D. E. Hardy; 39 males and 35 females Sanford, Florida, September 19, 1939, C. O. Bare; 9 males and 12 females, Brownsville, Texas, December 1945, R. H. Beamer; 2 males and 3 females McAllen, Texas, December 1945, R. H. Beamer; 6 males and 1 female. Okefenokee Swamp, Georgia, July 1939, R. H. Beamer.

Types and paratypes in The Snow Entomological Collections; paratypes in United States National Museum.

3. *Sogata dorsolineata* n. sp.

Macropterous form:

Resembling *Sogata furcifera* (Horv.) but aedeagal brace projected dorsally one half as high as length of styles. Length, male 4 mm.; female 4.5 mm.

Color: General ground color brownish; vertex, pronotum except large spot back of each eye and broad median longitudinal stripe on meso and metanotum white; carinae of front, large area below each eye and legs also white; elytra blackish except basal half and apical third of clavus and costal area from base to slightly beyond crossveins semi-hyaline. Females much lighter in color than males.

Genitalia: In lateral view pygofer semi-quadrangular; styles slightly enlarged on apices; aedeagal brace projecting caudally; aedeagus with sides almost parallel, apex rounded, covered with serrations; anal segment elongate with a pair of long, slender almost straight processes; in caudal view styles slightly enlarged at apices; aedeagal brace produced dorsally more than half length of styles, broadly rounded.

Holotype male, allotype female, 9 males and 8 female paratypes Brownsville, Texas, June 29, 1938, R. H. Beamer; other paratypes; 2 males and 2 females same place and collector July 3, 1938; 1 male Brownsville, Texas, January 4, 1932, E. D. Ball; 1 male and 1 female Southmost, Cameron County, Texas, April 13, 1950; 4 males and 1 female, Progresso, Texas, April 12, 1950.

Types and paratypes in Snow Entomological Collections, paratypes in United States National Museum.

4. *Pissonotus minutus* n. sp.

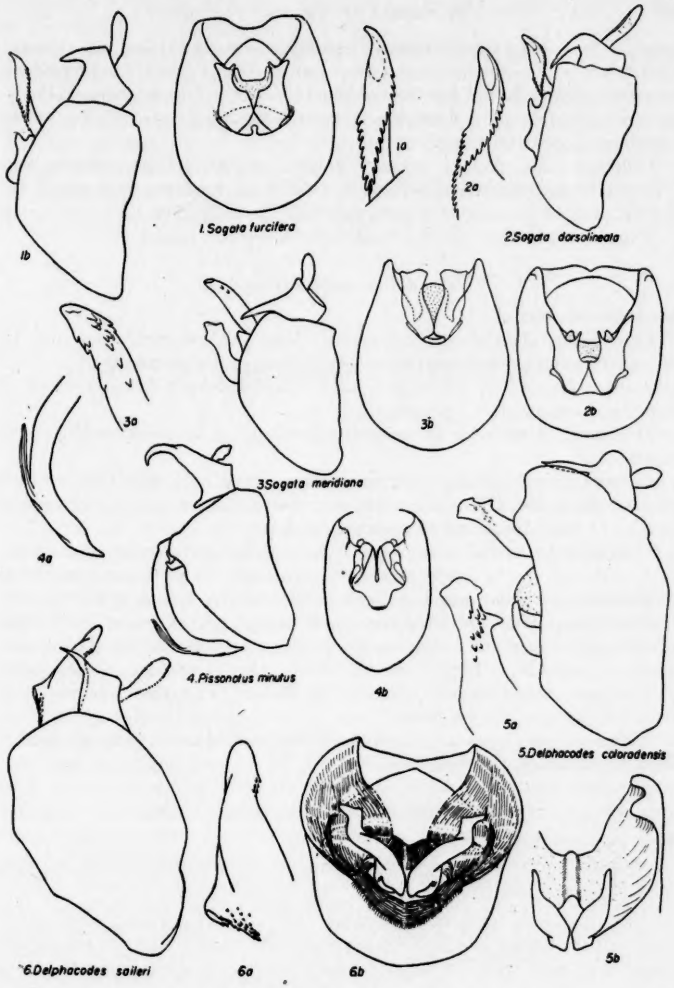
Brachypterous form:

Resembling *Pissonotus binotatus* Spooner but smaller, aedeagus with three dorsal processes of about same length and median processes of pygofer with sides converging to sharp apices and of about same length as styles. Length, male 1.8 mm.; female 2 mm.

Elytra almost rectangular, hind margin truncate, covering first segment of abdomen.

Color: General ground color shining black, apices of elytra with white band; legs on outer portions somewhat lighter.

Genitalia: In lateral view pygofer more or less triangular, caudal angle flat; aedeagus, parallel-sided almost as long as width of genital capsule, curved



EXPLANATION OF PLATE:

1. *Sogata furcifera* (Horv.): caudal view of pygofer with styles and aedeagal brace; 1a, lateral view of aedeagus much enlarged; 1b, lateral view of genital capsule.

2. *Sogata dorsolineata*: lateral view of genital capsule, 2a, lateral view of eadagus greatly enlarged, 2b, caudal view of styles and aedeagal brace.

3. *Sogata meridiana*: lateral view of genital capsule 3a, lateral view of aedeagus much enlarged, 3b, caudal view of styles and aedeagal brace.

4. *Pissonotus minutus*: lateral view of genital capsule; 4a, lateral view of aedeagus much enlarged, 4b, caudal view of pygofer with styles and processes.

5. *Delphacodes coloradensis*: lateral view of genital capsule; 5a, lateral view of aedeagus much enlarged; 5b, caudal view of pygofer with styles and aedeagal brace.

6. *Delphacodes saileri*: lateral view of genital capsule; 6a, lateral view of aedeagus much enlarged; 6b, caudal view of pygofer with styles and aedeagal brace.

ventrally, three long slender retrorse parallel processes on dorsal margin near outer third; anal segment short with a pair of long, curved, caudoventrally directed processes. In caudal view median processes as long as styles, converging to sharp apices; styles with sides more or less parallel, outer third of apices bent sharply outward, broadly rounded.

Holotype male, allotype female, 23 males and 33 female paratypes, San Francisco Mountains, Arizona, June 25, 1950, R. H. Beamer; other paratypes; 14 males and 13 females same place and time, L. D. Beamer.

Types and paratypes in The Snow Entomological Collections.

5. *Delphacodes coloradensis* n. sp.

Brachypterous form:

Resembling *Delphacodes campestris* (Van D.) externally but may be separated from it by the large pair of processes on anal segment, by the tapered apices of styles and by the large tooth on dorsal margin of apical third of aedeagus. Length, male 2.6 mm.

Structure: Elytra with apices rounded, extending to about middle of abdomen.

Color: General ground color stramineous with dark spot back of each eye and larger lateral one one each side of mesonotum, genae, lateroapical portions of front, meso and meta pleura, dark.

Genitalia: In lateral view pygofer more or less rectangular; styles pediform; aedeagal brace roundly protruding; aedeagus widest at base, narrowed to blunt apex with two heavy teeth on dorsal margin of outer third with numerous smaller teeth on outer third; anal segment with pair of long sharp processes. In caudal view styles widest at base gradually narrowed to slender apices; aedeagal brace highly arched, dorsal corner of pygofer inrolled, bifid.

Holotype male Colorado, 2024, C. F. Baker; paratypes: 3 males Little Beaver, Colorado, July 14, 1898.

Types and paratypes in United States National Museum; one paratype in Snow Entomological Collections.

6. *Delphacodes saileri* n. sp.

Brachypterous form:

Resembling *D. arcanostyla* Beamer but apices of styles pediform. Length, male 2 mm.; female 2.6 mm.

Structure: First segment of antennae not quite twice as long as wide; median carinae of front divided slightly below margin of crown; crown slightly longer than basal width, strongly carinate; elytra extending almost to genital capsule.

Color: Ground color of male black, carinae stramineous; narrow band of white on posterior margin of pronotum, dorsum of first abdominal segment of abdomen orange; elytra semihyaline; female generally much lighter than male, only dorsum of abdomen black.

Genitalia: In lateral view genital capsule more or less oval, narrowest on ventral margin, anal segment with a pair of slender, sharp, slightly curving processes; aedeagus with gonapore basad of middle on ventral margin, pedi-

form in general shape; styles hidden; in caudal view styles leg-like, apices pediform, aedeagal brace U-shaped.

Holotype male June 28, 1951, Allotype female June 24, 1951, Katzebue, Alaska, R. I. Sailer; 2 male and 3 female paratypes June, same place and collector, other paratypes: 1 male, Tanana, Alaska, June 6, 1951, R. I. Sailer; 1 male, Teller, Alaska, July 10, 1951, R. I. Sailer.

Types and paratypes in United States National Museum; one pair of paratypes in Snow Entomological Collections.

A NOTE ON THE LARVAE OF SPHECID WASPS

CHARLES D. MICHENER
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The larvae of sphecid wasps have been made rather well known during the last twenty-five years by the admirable works of Grandi, Micheli, Soika, and Maneval. Grandi's publications in particular are magnificently done and contain a wealth of illustrations of larvae of aculeate Hymenoptera, their nests, prey, inquiline associates, and the like.

The investigation upon which this note is based was undertaken in the hope of learning which group of sphecid wasps might be ancestral to the bees. The conclusion seems to be, like that based upon adult morphology, that no living group is ancestral to the bees.

The most striking characteristic of the larvae of sphecid wasps is the form of the salivary opening. In vespids (including eumenids), pompilids, scoliids, chrysidids, and many apoids, this opening is a broad transverse slit provided above and beneath by thin, weakly sclerotic lips. Considering its wide occurence, this must be the primitive form of salivary opening in the aculeate Hymenoptera. Among sphecids, however, it occurs only in the Sphecinae (e.g. *Ammophila, Sceliphron, Sphex*), wasps so specialized in adult structure that they could not be ancestral to bees. The Astatinae also have a slit-like undivided salivary opening, with the margins of the lips, however convex instead of straight as in the Sphecinae and most other aculeate Hymenoptera. All other sphecids (representatives of virtually all subfamilies and tribes are known) have the salivary opening divided. Sometimes (e.g. *Philanthus* and *Bembex*) the openings are on short broad projections, in others (e. g. *Cerceris*), the projections are slender and very widely separated, while in still others (e.g. the Larrinae) the projections are long and exceedingly slender with the openings apparently at their tips. Paired salivary openings are, thus, a distinctive feature of most sphecids, not found elsewhere in the Hymenoptera. It seems important that characters such as this be considered when a reclassification of the sphecid wasps is undertaken.

*Contribution No. 800 from the Department of Entomology, University of Kansas.

To save space, only two of Grandi's works are listed below; the first of them contains a list of his earlier papers on aculeates.

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A NEW BRACHYMYRMEX FROM NORTHERN UTAH

(Hymenoptera: Formicidae)

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During the spring of 1947, a colony of Brachymyrmex was taken from the lower portion of Big Cottonwood Canyon near Salt Lake City, Utah. Twenty-two workers were recovered from a nest located among the roots of the common scrub oak, *Quercus gambellii* Nuttall. The location was on the south exposure of a steep canyon wall at about 5500 feet elevation. The nest was uncovered by the removal of a small stone lying against one of the vegetative stems of a rather large clump of oak. Indications are that the species is quite scarce since further attempts to find additional colonies, both in the near vicinity and in other similar locations, proved fruitless. Since the members of this genus of ants rarely appear on the surface and live in a subterranean manner where they tend aphids and coccids on roots of plants, some difficulty in locating additional colonies would be indicated.

Brachymyrmex depilis subsp. *flavescens* n. subsp.

Worker.—Length, 1.5 mm. Shape of head and mandibles generally similar to *B. depilis,* but posterior border not as deeply indented. Clypeus broadly rounded in front. Antennal scape reaching to the posterior border of the head. Eyes small with average of 10 large ommatidia. Maxillary palpi short. Petiolar scale small with somewhat pointed border and appressed to the petiole.

Entire body opaque, the head and gaster more so than the thorax. Sculpturing medium and distinct.

Hairs and pubescence whitish in color. Pubescence fine, sparse on head and thorax but longer and more abundant on the gaster. Erect hairs sparse, few on the head, absent on thorasic dorsum; restricted to segmental margins on gaster.

Color whitish to pale yellow. Head usually darker than thorax and abdomen. Teeth and edges of mandibles tinged with brown.

Taxonomic studies indicate that the Utah form is closely allied with *B. depilis* Emery, 1893, of the eastern United States. Comparison with specimens collected by Gregg in Iowa, the nearest definite record, show morphological similarity in most major details. The Utah form can be readily distinguished from *depilis* by its lighter color, *depilis* being definitely brownish; by its smaller eyes, *depilis* having larger eyes with at least 20 ommatidia; by its coarse sculpture which renders the body opaque while *depilis* is more shining. The Utah form also has much sparser pilosity and pubescence with both hairs and pubescence being white instead of yellow.

The type series consists of 22 workers. Cotypes are deposited in the Entomological Collection at the University of Utah and in the U. S. National Museum in Washington, D. C.

A NEW SPECIES OF TROGONINIRMUS (Philopteridae: Mallophaga)

K. C. EMERSON
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Trogoninirmus eleganus n. sp.

Female: Head elongate, triangular; with slightly concave sides, and broad evenly rounded clypeal margin. A narrow v-shaped clypeal suture extends from near the mandibles forward with several small setae at the distal ends. Trabeculae small, pointed; extending to the second antennal segments. Antennae filiform; of medium length, first and second segments longer than the remainder. Eyes small. Temples oval-shaped, slightly expanded laterally and posteriorly; each with three short and one long setae. Posterior margin of head straight; gular plate small diamond-shaped.

Prothorax quadrangular, much wider than long; with one long seta in each posterolateral angle. Pterothorax with expanded posterolateral angles, and convex posterior margin. Two long setae in each posterolateral angle and a pair of long setae on each side of the median of the posterior margin.

Abdomen long, pear-shaped, with evenly rounded posterior margin. Tergites of segments I-IV with a projection on each posterolateral angle, and a long seta just median to the projection. Large distinct tergal plates on segments I-VIII separated medianly. One long seta in the posterolateral angle of tergites III and IV and two on tergites V-VII. Eight smaller setae on the posterior margin of tergites I-VI and six on tergite VII. Pleural plates thickened on segments I-VIII. Sternal plates small, indistinct and each with four medium-length setae. Genital opening large, posterior margin of vulva with a fringe of small setae.

Male: Head approximately the same size as in the female. Thorax and abdomen essentially the same shape as in the female, but smaller. Chaetotaxy except for the posterior abdominal segments, same as in the female. Genitalia large; stout, short crescent-shaped parameres.

Type host: Trogon elegans elegans Gould.

Type material: Holotype female, allotype male, and four paratype females collected by Mr. Richard E. Tashian near Uzumatlán, Department of Zacapa, Guatemala.

Discussion of the genus.

Carriker (1903) described *Nirmus hastiformis* from a single female collected from *Trogon violaceus concinnus* Lawrence, and noted that it could be separated from the remainder of the old genus *Nirmus* (now *Degeeriella*) by "the rounded front, with concave sides, completely encircled by the antennal bands; by the length and shape of the eighth segment of the abdomen and the presence of the broad, transverse abdominal bands."

Eichler (1944) erected the genus *Trogoninirmus* for this form and *Nirmus sulphureus* Giebel 1876, designating the former as genotype. His generic description is largely "die diagnose von Carriker."

Guimarães (1944) described *Degeeriella odontopleuron* from *Trogon surrucura aurantius* Spix. He pointed out that the morphological characters show a close relationship between that species and the genus *Cuculicola,* found on the Cuculiformes. An examination of his description and illustrations prove that this species should be included in the genus *Trogoninirmus.*

Nirmus sulphureus Giebel 1876 is without a proper host-record, the description is inadequate and the type is apparently lost; so it is unrecognizable at the present time, and should be discarded.

The new form described is the third recognizable species in the genus, all of which are found on the avian order Trogoniformes. It is the largest of the three; the female is 1.9 mm in length, while *T. odontopleuron* is 1.8 mm and *T. hastiformis* is 1.7 mm in length. The additional setae on the tergites also aid in its separation from the other species.

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CONTENTS OF THIS NUMBER

A Monographic Study of the African Bibionidae (Diptera) Part III, Genus Plecia
D. Elmo Hardy 81

A Study of the Membracid Genus Centrodontus (Homoptera)
Paul P. Cook, Jr. 92

Maturity of Corn and Life History of the Angoumois Grain Moth
H. D. Koone 103

Distributional and Synonymical Data and Descriptions of Two New Hydrometra (Hemiptera: Hydrometridae)
C. J. Drake and F. C. Hottes 106

One Old and Five New Species of Delphacine Fulgorids (Homoptera: Fulgoridae)
R. H. Beamer 111

A Note on the Larvae of Sphecid Wasps
Charles D. Michener 115

A New Brachymyrmex from Northern Utah
Albert W. Grundmann 117

A New Species of Trogoninirmus (Philopteridae: Mallophaga)
K. C. Emerson 118

81
92
03
06
11
15
17
18